



STATE OF WASHINGTON

## STATE BUILDING CODE COUNCIL

### Washington State Energy Code Development Standard Energy Code Proposal Form

May 2018

Log No. \_\_\_\_\_

Code being amended: ☒ Commercial Provisions ☐ Residential Provisions

Code Section # C406.13

Brief Description: Provides path to a C406.1 credit for projects incorporating design and installation of a heat pump to maintain domestic hot water recirculation temperature in lieu of electric resistance. Systems implementing this approach will result in reduced energy use compared to electric resistance heat.

Proposed code change text: (Copy the existing text from the Integrated Draft, linked above, and then use underline for new text and ~~strikeout~~ for text to be deleted.)

**C406.13– High performance service hot water temperature maintenance system** Systems with a multi-riser service hot water circulation shall be provided with an airsource or watersource heat pump for temperature maintenance. Service hot water system delivering heating requirements using heat pump technology with a minimum COP of 2.0. For air-source equipment, the COP rating will be reported at the design leaving heat pump water temperature with an entering dry bulb air temperature of 60°F (15.6°C) or lower and a relative humidity of 50% or lower. For water-source equipment, the COP rating will be reported at the design leaving load water temperature with an entering water temperature of 74°F (23.3°C) or lower. System shall comply with C404.7.1.

*TABLE C406.1  
EFFICIENCY PACKAGE  
CREDITS*

Code Section	Commercial Building Occupancy					
	Group R-1	Group R-2	Group B	Group E	Group M	All Other
	Additional Efficiency Credits					
1. More efficient HVAC performance in accordance with Section C406.2	2.0	3.0	3.0	2.0	1.0	2.0
2. Reduced lighting power: Option 1 in accordance with Section C406.3.1	1.0	1.0	2.0	2.0	3.0	2.0
3. Reduced lighting power: Option 2 in accordance with Section C406.3.2 <sup>a</sup>	2.0	3.0	4.0	4.0	6.0	4.0
4. Enhanced lighting controls in accordance with Section C406.4	NA	NA	1.0	1.0	1.0	1.0

5. On-site supply of renewable energy in accordance with C406.5	3.0	3.0	3.0	3.0	3.0	3.0
6. Dedicated outdoor air system in accordance with Section C406.6 <sup>b</sup>	4.0	4.0	4.0	NA	NA	4.0
7. High performance dedicated outdoor air system in accordance with Section C406.7	4.0	4.0	4.0	4.0	4.0	4.0
8. High-efficiency service water heating in accordance with Sections C406.8.1 and C406.8.2	4.0	5.0	NA	NA	NA	8.0
9. High performance service water heating in multi-family buildings in accordance with Section C406.9	7.0	8.0	NA	NA	NA	NA
10. Enhanced envelope performance in accordance with Section C406.10 <sup>c</sup>	3.0	6.0	3.0	3.0	3.0	4.0
11. Reduced air infiltration in accordance with Section C406.11 <sup>c</sup>	1.0	2.0	1.0	1.0	1.0	1.0
12. Enhanced commercial kitchen equipment in accordance with Section C406.12	5.0	NA	NA	NA	5.0	5.0 (Group A-2 only)
<b>13. High performance temperature maintenance system</b>	<b><u>3.0</u></b>	<b><u>3.0</u></b>	<b><u>1.0</u></b>	<b><u>1.0</u></b>	<b><u>1.0</u></b>	<b><u>1.0</u></b>

- a. Projects using this option may not use Item 2.
- b. This option is not available to buildings subject to the prescriptive requirements of Section C403.3.5.
- c. Buildings or building areas that are exempt from thermal envelope requirements in accordance with Sections C402.1.1 and C402.1.2 do not qualify for this package.

Purpose of code change:

Systems implementing this approach will result in reduced energy use compared to electric resistance heat.

Your amendment must meet one of the following criteria. Select at least one:

- ☐ Addresses a critical life/safety need.
- ☐ Consistency with state or federal regulations.
- ☐ The amendment clarifies the intent or application of the code.
- ☐ Addresses a unique character of the state.
- ☒ Addresses a specific state policy or statute.  
(Note that energy conservation is a state policy)
- ☐ Corrects errors and omissions.



STATE OF WASHINGTON  
**STATE BUILDING CODE COUNCIL**

Check the building types that would be impacted by your code change:

☐ Single family/duplex/townhome

☒ Multi-family 4 + stories

☒ Institutional

☐ Multi-family 1 – 3 stories

☒ Commercial / Retail

☒ Industrial

Your name              Reginald Christor

Email address              reggiec@rushingco.com

Your organization      Rushing Company

Phone number              206-535-8710

Other contact name Eric Vander Mey

**Instructions:** Send this form as an email attachment, along with any other documentation available, to:  
[sbcc@des.wa.gov](mailto:sbcc@des.wa.gov). For further information, call the State Building Code Council at 360-407-9278.

## **Economic Impact Data Sheet**

Briefly summarize your proposal's primary economic impacts and benefits to building owners, tenants and businesses.

Pursuit of credit as proposed will increase domestic hot water circulation system efficiency and could reduce energy costs incurred by the owner, tenant or business. Current code allows for electric resistance heating for circulation temperature maintenance, which at best has a COP of 1.0. Heat pumps typically operate at a COP of 2.0 or greater, which would directly translate to an energy use reduction.

Provide your best estimate of the construction cost (or cost savings) of your code change proposal? (See OFM Life Cycle Cost [Analysis tool](#) and [Instructions](#); use these [Inputs](#). **Webinars on the tool can be found [Here](#) and [Here](#)**)

\$NA/square foot (For residential projects, also provide \$NA/ dwelling unit)

Show calculations here, and list sources for costs/savings, or attach backup data pages

As this is a proposed change to the C406 section this is an option that an owner can pursue if they choose this option and determine that it is cost effective. Therefore, cost analysis information has not been provided as it is not a mandatory requirement of the code.

Therefore, only information is provided as to the energy and/or carbon emissions savings. The Energy Code TAG may need to adjust the number of credits for based on final code language for this credit or other credits.

Provide your best estimate of the annual energy savings (or additional energy use) for your code change proposal?

0.247 KWH/ square foot (or) [Click here to enter text](#).KBTU/ square foot

(For residential projects, also provide [Click here to enter text](#).KWH/KBTU / dwelling unit)

Show calculations here, and list sources for energy savings estimates, or attach backup data pages

**All questions must be answered to be considered complete. Incomplete proposals will not be accepted.**

Per the *Multifamily Billing Analysis: New Mid-Rise Buildings in Seattle* report Ecotope produced for Seattle in 2009, 25% of total building energy use was for DHW, and 20% of useful DHW heat is lost due to circulation and distribution losses:

Energy bills were divided into primary end uses and were found to have roughly the following average distribution:

- 25% for domestic hot water (DHW)
- 25% for non-heating electrical use in the apartments
- 25% for non-heating electrical use in the common residential spaces
- 25% for space heating – of which
  - half is used in the apartment units and
  - half is used in the common area corridors and lobbies

**Table 1: Normalized Energy Use (kWh/ft<sup>2</sup>/yr)\*, Averages for 10 Multifamily Buildings**

Building	DHW	Residential Space Heat	Common Area Space Heat	Common Area Other	Residential Other	All
Average	3.07	1.8	1.25	3.28	2.8	12.2
Median	3.08	1.2	1.43	2.89	2.84	11.44
Aggregate Ratio <sup>1</sup>	2.8	1.2	1.23	2.96	2.8	10.99

\* Includes all gas and electric energy reported as simple energy units of kWh. To convert to kBtu multiply by 3.413 kBtu/kWh.

Since most of the domestic hot water systems are central water heaters, more than 60% of all the energy use in these buildings is *not* in the apartment units. The major end uses evaluated were divided into several categories:

**DHW:** All but one of these buildings has a central gas-fired hot water system. When present, these systems are the single largest energy consumers in the building. Most of these systems are 80% efficient boilers and another 20% of the heat energy is lost in the continuously circulating distribution system. More research and design alternatives are needed to reduce hot water use and distribution losses.

Assuming average annual efficiency of 80% on the boilers, the net annual DHW LOAD would be  $3.08 \text{ kWh/ft}^2/\text{yr} \times 0.8 = 2.464 \text{ kWh/ft}^2/\text{yr}$ . The 20% that is lost in recirculation equates to  $2.464 \text{ kWh/ft}^2/\text{yr} \times 0.2 = 0.493 \text{ kWh/ft}^2/\text{yr}$ .

Typical practice would be to use electric resistance heat to make up for the distribution and circulation losses, but if a 2.0 COP heat pump was used instead, the recirc reheat energy use would drop from  $0.493 \text{ kWh/ft}^2/\text{yr}$  to  $0.247 \text{ kWh/ft}^2/\text{yr}$ .

List any code enforcement time for additional plan review or inspections that your proposal will require, in hours per permit application:

Estimate additional 1 hour to verify the circulation system equipment type and efficiency on plan review or in field.

**All questions must be answered to be considered complete. Incomplete proposals will not be accepted.**